Ames Laboratory Strategic Facilities Plan
FY2003—FY2013

I. Executive Summary

Ames Laboratory, a Department of Energy (DOE) research facility, has unique advantages in its relationship with Iowa State University (ISU). The Laboratory facilities integrated with the ISU campus infrastructure provide a campus-like atmosphere for its employees. This integration makes it very cost effective to operate the Laboratory. The average age of the research buildings is 48 years, but Laboratory management has devoted adequate funding for the upkeep of these government buildings so they remain in excellent condition. In recent years, however, Laboratory support from DOE has diminished at a time when the aging buildings require greater resources to maintain. In addition, research infrastructure requirements continue to change at a faster pace than in the early years of the Laboratory. Today's research requires greater flexibility that does not exist in our current structures. Therefore, this plan outlines Ames Laboratory's proposal for investments needed to meet the research needs for the 21st century. This proposal includes the addition of a new research facility, vacating a building used for low level waste handling, remodeling existing research facilities, consolidating research groups into contiguous space, cleaning up Harley Wilhelm Hall, and an increased annual commitment to the care and maintenance of the existing facilities. The funding required to accomplish these goals is included.

The modest investment proposed in this plan will allow the Ames Laboratory to achieve the vision of creating research facilities suited for world-class research well into the 21st century. This is in keeping with the tradition at the Laboratory to have a long-term perspective on the facility needs of our researchers and on our fiduciary responsibility to maintain and preserve the assets entrusted to us by the Federal Government.

II. Mission Future of the Laboratory

A. Overall

The Laboratory's mission is to conduct fundamental research in the physical, chemical, materials, and mathematical sciences and engineering which underlie energy generating, conversion, transmission and storage technologies, environmental improvement, and other technical areas essential to national needs. These efforts will be maintained so as to contribute to the achievement of the Vision of the Department of Energy. More specifically, it will increase the general levels of knowledge and technical capabilities, develop new technologies and practical applications arising from our basic scientific programs, transfer applicable technologies developed at the Laboratory to U.S. industry, and prepare engineering and physical sciences students for the future. To this end, Ames Laboratory capitalizes on its close connection with Iowa

State University to carry out interdisciplinary research focused on national issues.

B. Programmatic

Ames Laboratory's scientific component is organized into 8 research programs:

Administrative Services/New Initiatives
Applied Mathematics and Computational Sciences
Chemical and Biological Sciences
Condensed Matter Physics
Environmental and Protection Sciences
Materials Chemistry
Metal and Ceramic Sciences
Nondestructive Evaluation

These programs perform research in the areas of synthesis and processing of rare-earth materials with unique purity, crystal structure and desirability, metals and intermetallics, ceramics, polymers, advanced computing systems, parallel computing, forensic science and instrumentation, monitoring of heavy metals, industrial and DOE facility processes, nondestructive analysis, photonic band gaps, quasicrystals, sensing devices, instrumentation for genomic mapping, and others. Included within the Metallurgy and Ceramics Program is the Materials Processing Center, a DOE user facility, that prepares ultrapure materials for research worldwide. The MPC has recently purchased new state-of-the-art instrumentation and also funds research to develop new materials preparation and processing techniques.

The Administrative Services/New Initiatives (ASNI) program serves two purposes. First, it is the home of Ames Laboratory activities that require technical expertise, but are not themselves research programs. Specifically, technical management tasks performed by Ames Laboratory personnel for DOE are administered in this program. Second, it serves as a home for research activities that are fundamentally new to the Laboratory. These often fall within the scope of the DOE mission, but sometimes involve another customer agency. For example, one such area is in biorenewable energy and products. The Ames Laboratory is in the process of developing a Biorenewable Resources Consortium through collaboration with Iowa State University.

As part of the Applied Mathematics and Computational Sciences, the Scalable Computing Laboratory (SCL) focuses on high performance computing with attention to its rapidly changing nature. Current key research areas include developing new methods for hardware and software interconnects, developing more efficient and robust approaches to message passing and resource management, and developing new methods for handling huge data sets in a parallel environment.

The Chemical and Biological Sciences Program focuses on research spanning fundamental and applied projects relevant to the mission of the DOE. Specific projects are:

Photochemistry & Photobiology: Providing fundamental understanding of the variety of processes that are basic to solar energy conversion in biological systems, with application to the development of new solar energy technologies. Energy-transfer processes in the light-harvesting structures of plants are examined with fluorescence spectroscopy and hole-burning spectroscopy. Chromophoric polymers are studied to explore mechanisms of efficient electronic energy transport and capture in solar energy conversion.

Chemical Physics: Theoretical and experimental investigations are focused on the structure, bonding, reaction mechanisms, and dynamics of chemically reactive systems in terms of their fundamental atomic, molecular, and electronic constituents. The goal is the understanding of heterogeneous catalytic systems. Experimental efforts complement the theoretical efforts by providing accurate thermochemical data for molecules and transient radicals.

Catalysis & Chemical Transformation: Fundamental studies are being carried out relating to selective oxidation, desulfurization, hydrogenation, and, in particular, processes that remove or add a heteroatom. Catalysts are being designed, synthesized, and modified with many studies of mechanisms, intermediates, and active sites. Oxo-transfer and hydrogenation reactions are central to this activity, which is aided by the application of molecular compounds tethered to a catalyst surface. Application of solid-state NMR allows the definitive characterization of solid catalysts.

Separations & Analysis: New methodologies in analytical chemistry and separations science are being developed to address advances in heterogeneous and homogeneous catalysis, nanotechnology, biomimetic systems, environmentally-benign chemistry, and toxic waste clean-up.

Biological Imaging: This project is concerned with the development of two new laser-based technologies for the study of biological insult from environmental chemical carcinogens at the cellular and sub-cellular levels.

The Condensed Matter Physics (CMP) Program conducts basic research focused on the synthesis, characterization, and modeling of new materials. The work underpins the development and optimization of materials relevant for utilization in various energy technologies.

Neutron and X-ray Scattering: Neutron scattering studies have been instrumental in elucidating the basic science of hundreds of new materials

and crystals first developed at the Ames Laboratory. Currently, our neutron scattering studies are mainly conducted at the High Flux Isotope Reactor (HFIR) at ORNL, although facilities at IPNS (Argonne), NIST, and in Europe are also utilized.

Experimental Condensed Matter Physics: Magnetism, superconductivity, photonics, surfaces, transport, conducting polymers, and the synthesis of new materials are among the major topics explored with a diverse set of techniques.

Theoretical Condensed Matter Physics: Theory and experiment are perhaps best classified as approaches to science. Simulation or computation is now regarded by many as a third approach, although it is perhaps better to think of computing as a remarkable enabling tool for both theory and experiment. All of the "theorists" at Ames Laboratory are deeply engaged with experimental groups. Two years ago the Computational Materials Sciences Network (CMSN) was set up to support teams of researchers to come together across interdisciplinary and inter-institutional lines and work together on large and important problems. Ames has been the lead laboratory in coordinating CMSN. So far, five separate projects have been funded with about 15 to 20 scientists working in each.

The Environmental and Protection Sciences (EPSCI) Program focuses on providing applied analytical solutions to problems in security and environmental quality:

National Security: A collaborative effort between Ames Laboratory and researchers at Lawrence Berkeley National Laboratory, funded by NA-22, involves the development of Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) instrumentation and methods for the direct analysis of materials related to nuclear proliferation. A project originally funded by NA-22, but now funded through a WFO by the FDA Center for Veterinary Medicine, involves the development of a database of veterinary laboratories and experts who would be able to respond with analyses in the event of a terrorist attack on livestock.

The Midwest Forensic Resource Center is a cooperative effort of the Ames Laboratory and crime laboratories in an 8-state region (including WI, MN, ND, SD, NE, KS, MO, and IA). The Center pools the needs of these laboratories and addresses them through a four-part program of work in casework, training, research, and education. Funding began in late FY2002 through an interagency agreement with the National Institute of Justice in its Crime Laboratory Improvement Program.

Another funded project for the FBI involves the development of image-reduction and statistical tools for the comparison of toolmarks produced in

hard metals (such as on a screwdriver, pry bar, or blade) by various industrial-machining methods.

Environmental Quality: A project funded on a WFO contract for ORNL (as a subcontract for a SERDP project) involves the development of optimal sampling strategies for unexploded ordinance. A project funded by EM-50 involved the development of on-line continuous emission monitoring systems for heavy metals including As, Be, Cd, Cr, Pb, Sb, and Hg. A reduced-pressure inductively coupled plasma – atomic emission system, equipped with a compact high-resolution spectrometer, was developed and tested for continuous multi-metal monitoring of waste-treatment exhaust stacks. A specialized continuous on-line mercury monitoring system, capable of more sensitive detection of both elemental and total mercury, was also developed and tested as part of this project.

The Materials Chemistry Program goal is to synthesize and understand the principles governing the stabilities and properties of two classes of solid-state materials: polymers and metal-rich inorganic compounds. In both, development of heretofore-unknown materials is emphasized. Within the class of metal-rich inorganic compounds, a specific goal is to understand the electronic and atomic structure of quasicrystals – metallic alloys with long-range positional order but without periodicity – both in the bulk and at the surface.

The Metal and Ceramic Sciences Program (formerly called Metallurgy and Ceramics) core research areas are (1) Structure and Composition of Materials, (2) Mechanical Behavior and Radiation Effects, (3) Physical Behavior of Materials, and (4) Synthesis and Processing Science. The research activities within the Metal and Ceramic Sciences Program all contribute in some manner to the DOE mission in all areas of national security, fossil energy, fusion energy, nuclear energy, transportation systems, industrial technologies, energy efficiency, and environmental management. These contributions stem in part from the basic precept that the properties and performance of all materials are critically dependent upon their structure and composition. To that end, an overarching theme of the research conducted within the Metal and Ceramic Sciences Program is to further understand the complex linkages between the synthesis, structure, properties, and performance of novel and advanced materials.

In FY01-FY02, the Metal and Ceramic Sciences Program underwent a thorough self-assessment and restructuring. The outcome of the restructuring was the formation of the following three research focus areas:

- Magnetism
- Science of Amorphous and Aperiodic Materials
- Solidification Science

These focus areas were added to an already established and internationally recognized project within the Program concerned with “Extraordinary

Responsive Magnetic Rare Earth Materials," which teams researchers from various programs in the Ames Laboratory and complements a major effort within the Magnetism focus area. As a consequence of the restructuring, some previous research efforts were either discontinued or modified, while some other efforts were given greater emphasis. There were also a number of emergent or unresolved research efforts that are at the cutting edge of research, but are outside the scope of the focus areas. Those efforts are being continued with the expectation that some will grow into larger multi-researcher projects. Examples of those research efforts include: "Gas Atomization Process Physics," "Mechanics and Mechanisms of Deformation and Microstructural Evolution," "Ab Initio Studies of Defect Structures and Phase Transformations," "Environmentally Benign Gelcasting of Ceramics," and "Mechano-Chemistry of Ionic and Molecular Materials."

The scope of the main areas of BES research in the Metal and Ceramic Sciences Program is described in the following.

Magnetism: Directed towards understanding the interplay between competing energy contributions in determining critical magnetic phenomena. Of particular interest are materials systems containing magnetic rare earths, transition metals, or both, where characteristic structural dimensions are on the order of the magnetic interaction lengths, or the energy difference between crystalline states is of the same order as the energy difference between magnetic states. The goal is to describe, understand, and manipulate physical interactions propagating over spatial scales from atomistic to macroscopic and temporal scales that vary over several orders of magnitude.

Science of Amorphous and Aperiodic Materials: The main goals of this focus area are to gain an increased fundamental understanding of (1) the correlation between short-range atomic order and the devitrification and deformation behavior in amorphous systems and (2) the role of crystal chemistry (i.e.; structure, bonding, and lattice energies) in controlling the structural stability of aperiodic systems.

Extraordinary Responsive Magnetic Rare Earth Material: Research is directed towards analytical and systematic experimental studies of the unique magnetic-martensitic phase transformation in $R_5(Si_xGe_{1-x})_4$ materials, where R is Gd and other lanthanides, to achieve understanding of the underlying electronic structure and the microscopic interactions bringing about extremely strong coupling of the magnetic moments with the lattice. Another goal is the development and validation of models of the magnetic-martensitic transformation, which will allow for the design of novel material systems exhibiting extremely large responses to small changes of magnetic field, temperature, and pressure.

Materials Synthesis and Processing: An important and unique feature of the Ames Laboratory is its Materials Preparation Center (MPC), which is managed by the Metal and Ceramic Sciences Program. The MPC is a user facility that is primarily dedicated to the preparation, purification, and characterization of metallic materials. The MPC enables fundamental research by providing users, on a full cost recovery basis, high-purity materials of tightly controlled chemistries that are not available from commercial suppliers. Users may also conduct a materials processing research activity funded by, and in collaboration with, the MPC through a recently established, BES-sponsored Process Science Initiative (PSI).

The Non-Destructive Evaluation Program goal is to develop new analytical techniques and instrumentation for use where traditional destructive techniques are not cost effective. This program is entirely housed in off-campus University-owned space.

In addition to continued successful research in its core programs, the Laboratory has as a goal the continued development of several major initiatives, which build upon the strengths of our programmatic research. These are summarized in the following paragraphs. Additional information on these initiatives can be found in the Institutional Plan.

- As an outgrowth of the Molecular Processes Program, the Laboratory and ISU is creating a Catalysis Center. This Center will facilitate the exchange of scientific information and promote collaboration between various groups and Laboratories involved in DOE-sponsored catalysis research.

- The Center will also serve as a resource for DOE-catalysis efforts by bringing together scientists, equipment, and facilities at Ames Laboratory and Iowa State University. The scientists at the Center will conduct research in homogeneous and heterogeneous catalysis and biocatalysis directed toward chemical synthesis and processing.

- Building upon existing research in the Physical and Biological Chemistry Program, and several proposals submitted to the Office of Biological and Environmental Research, Ames Laboratory is proposing a major initiative in the area of biochemical characterization and instrumentation. Biological research at Ames Laboratory is nurtured by the symbiotic interaction with the internationally-recognized programs in biological spectroscopy, analytical instrumentation development, and the computational expertise of the Laboratory's Scalable Computing Laboratory (leaders in development and use of low-cost parallel processing clusters). In addition to the Laboratory's infrastructure, which virtually demands interdisciplinary interaction, the unique intermarriage of the Ames Laboratory and Iowa State University provides all of the advantages expected in a research university with current and historical strengths in a wide variety of biological and biochemical research areas. The Laboratory offers all of the advantages of

the structure and expertise of a National Laboratory in combination with the attractive features of a research-oriented university to provide a unique and outstanding environment for cross-disciplinary interactions that generate novel solutions to a variety of important biological questions.

- An initiative in Hydrogen Generation and New Materials will address several critical issues, which have prevented the successful development of hydrogen as a fuel for the future. The effort includes a companion demonstration project that will utilize scientific developments arising from the project and put these improvements into practice in a rural setting. The results of this initiative may produce significant impact at the state and national levels; initially, it has the potential to make the State of Iowa self-sufficient in energy, using only abundant renewable resources. Energy dependency is a critical issue nationwide, and a successful Iowa hydrogen economy model could potentially demonstrate a clean, sustainable energy technology that could be implemented nationwide.

Finally, the following three initiatives have been submitted for consideration and funding through the Nano-science and Technology Initiative.

- Photonic Band Gap Materials: Ames Laboratory scientists pioneered the field of photonic band gap (PBG) materials over ten years ago. Since that time the field has exploded, with over 100 active groups in the world. While funding resources from BES have decreased over these ten years, the success, reputation, and skills of the Ames PBG researchers have increased tremendously. The field is now pushing into the infrared, optical, and ultraviolet regimes, where fabrication techniques for 3D structures at the submicron (nano) level are involved and costly to investigate. The resources required to maintain leadership and make timely progress are considerable. For this reason, the Laboratory has proposed a new initiative aimed at obtaining the resources to maintain and extend the competitive advantage the Ames Laboratory has in this emerging area of science.

- Magnetic Molecules: One of the rapidly expanding sub-fields within nano-magnetism is that of magnetic molecules. These materials offer an ideal "laboratory" to understand how complexity develops as the number of interacting magnetic ions grows from three or four to thirty, forty, or more. Each molecule has a fixed number of magnetic ions, and single crystals of the molecules can be grown large enough that powerful neutron and x-ray techniques can be used to probe their structure and elementary excitations. This is an area where Ames Laboratory has pioneered initial studies. A team of scientists is now proposing a larger nano-science project, which will establish Ames as the leading center in the U.S. for magnetic-molecule research. The mission is to synthesize new molecules, characterize their magnetic interactions with a variety of experimental and theoretical methods, and make predictions of new molecules with unique and possibly exploitable properties. Already these systems are being used to understand

quantum coherence and are being considered at qubits for quantum computing.

- Bioinspired Polymer Nanoassemblies: The overall goal of this initiative is to design and synthesize materials based on novel block copolymer nano-assemblies that are inspired by, and mimic living systems in their ability to sense their surroundings, switch among several states in response to the environment, self-assemble and build complex structures hierarchically and enable selective transport across membranes. This work lays the foundation to create a body of knowledge, both experimental and theoretical, that will provide answers to several important questions at the interface of materials, nano-technology, and biology. It will elucidate fundamental nanostructure-function relationships including polymer-biomolecule interactions.

III. Infrastructure Vision, Goals, and Objectives

The Ames Laboratory will strive to provide and maintain infrastructure to meet its current needs and conduct world-class research far into the future. Ames Laboratory facilities will be safe, secure, and environmentally responsible. The facility will be managed to maximize effectiveness and efficiency, building on the strengths of the unique partnership with ISU so that the Ames Laboratory will continue to be the most cost-effective Laboratory in DOE. The Laboratory is committed to a long-term perspective toward maintaining the facilities, thus avoiding decisions with short-term benefits that have long-term consequences. The facility will be maintained in excellent to outstanding condition as described by the Facility Condition Index. Infrastructure improvements will be done to keep pace with advancing technology and new paradigms of scientific collaboration so the research efforts are not restricted. The facility and facility management activities must be flexible and adaptable to enable Program efforts to respond efficiently to new developments and changing priorities in the increasingly dynamic research environment.

IV. Facility and Infrastructure Issues

The Ames Laboratory operates in government-owned buildings that are located on approximately 10 acres of University land that has been leased to the Federal government on a long-term, 99-year basis. The facility is integrated into the ISU campus in such a way that ISU provides and maintains the site-wide infrastructure (e.g. heating plant, chilling plant, roads, etc.). In effect, the Laboratory experiences the benefits of “third party financing” by the very nature of our operation. Because of this unique partnership, both the Laboratory and the University are significantly impacted in site development issues around the lease area of the Laboratory. The Laboratory's interests in the University's overall site-planning considerations are represented by the interactions of Laboratory officers and senior staff members with the major University committees and bodies that are responsible for campus planning, physical facilities, long-range development, and space utilization.

The Laboratory occupies approximately 325,000 gsf in government-owned buildings. Over 70 percent of this space are contained in three major research-use buildings built between 1949 and 1960. The average age of these laboratory buildings is 48 years. An office-use building, of less than 15% of the total, was built in 1994 and consolidated most administrative and support functions in one location for improved efficiency, allowed space in other buildings to be redirected to research activities, and decreased space rented from the University. The balance of the space is contained in several small auxiliary buildings constructed during the 1960's. These buildings house storage space, records handling and storage, material-receiving areas, warehouse functions, and shop facilities.

Laboratory operations utilize not only the Federally-owned buildings of the main site, but also space in University-owned buildings adjacent to the main site. Ames Laboratory has research activities totaling 63,000 square feet in the University buildings. Because of partnering with University research efforts and sharing this space, the Laboratory is charged for the equivalent of 30,000 square feet (~15% of the government-owned space). Because of the resource limitations of the University, they are not able to maintain and update these facilities to the same standard that the Laboratory maintains in the government-owned buildings. The ISU Campus Master Plan targets one of the buildings with approximately 5,000 nsf of Laboratory utilized space for demolition with plans to relocate some Ames Laboratory research laboratories and offices into the new Carver Co-Lab. As such, no improvement reinvestments and minimal maintenance efforts are going into the building.

A University-owned support building approximately 1.5 miles away at the Applied Sciences Center Site (formerly the Ames Laboratory Research Reactor) is utilized for handling and packaging low level contaminated waste for shipment to waste sites. DOE has beneficial use of this building through 2060. The building is in poor condition. The Laboratory is responsible for maintenance and operation of the building. The Laboratory is planning to relocate the operations contained in the building into space in other Laboratory buildings. Because the occupancy of the building is uncertain and the decommissioning plan may result in demolition of the building, minimal maintenance is being done.

The advancing age of the government-owned buildings is also a significant issue. The average age of the research buildings is 48 years. The general condition of the Laboratory's buildings is excellent; however, modernization is required. It has historically been the policy of Laboratory management to devote adequate attention and resources to facilities maintenance although, in recent years, budget restrictions and the increasing demands of aging buildings have rendered this policy more difficult to follow. The Deferred Maintenance recorded in the FIMS database is $1.55M resulting in a FCI of 2.3 percent. At this point, the facility is in excellent condition based on the FCI and the deferred maintenance total is not increasing. While the infrastructure is being maintained in excellent condition, the ability to modernize to provide "21st Century" laboratory space is limited because of funding priorities and the basic structure of 50-year-old buildings.

GPP funding is $515K for FY2003. The average funding from FY1992 to FY1995 was ~$800K. From FY1996 to FY2002 GPP funding was ~$500k per year. With recent trends being essentially flat, the ability to upgrade and modernize the infrastructure continues to erode. Larger projects must be phased over several years because they cannot be funded within a single year's GPP allocation. Again, this limits the infrastructure improvements that can be made to upgrade and modernize the buildings systems and space.

In order to provide "Laboratories of the 21st Century," continuous improvements in Information Technology Infrastructure will need to be accommodated. Improvements in the network infrastructure, security, central services, and remote accesses are included in this ten-year plan. Where technology will take us in the next ten years is hard to predict other than the fact that communication speeds will increase and more people will be "connected" in some way or another. As seen in the past year, Cyber security will grow in its importance with the increase in use of centralized services, remote access, and offsite collaborations.

V. Planning Assumptions

In developing this plan the following assumptions were used:

A. The Laboratory will see growth at the level of inflation or modestly above. This is based on the fact that our core competencies continue to be vital to the DOE, plus we are pushing out into the new areas discussed earlier (biorenewable resources, biochemical characterization and instrumentation, catalysis and forensics). The Laboratory will have to see modest growth in core funding in order to increase the annual level of maintenance provided to the facility and move in a positive direction toward the targets established by DOE.

B. The Office and Laboratory Building, a University-owned building that we currently occupy space in, will be demolished. The University has this action in its long-term facilities plan, but has not set the date yet. This will require relocation of one research group and several other offices into the new University-owned Carver Co-Lab.

C. A new Government-owned research facility will be constructed to accommodate several research groups that we seek to grow or are currently spread out among DOE- and/or University-owned buildings and who would benefit from contiguous space. At present, this facility would house the Physical and Biological Chemistry Program (relocated from Gilman Hall, a University-owned and maintained building), the Computational Sciences group, the Biorenewable Resources Consortium, the Midwest Forensic Research Center and the new Catalysis Center. This new facility would provide greater flexibility for researchers to develop a working environment that is better suited to their current and future research needs.

D. The Laboratory's efforts to develop new partnerships and collaborations through the use of WFO agreements and CRADAs will continue to grow. This anticipated growth will not only help maintain our core competencies but increase the operating funds available to support the Laboratory.

VI. Plan for Modernization

A. Site

Ames Laboratory has unique advantages in being located on the Iowa State University campus. The majority of the site infrastructure requirements are provided through the partnership with the University. For example, roads, sidewalks, and parking are provided and maintained by the University. Small parking areas and sidewalks associated with individual buildings are maintained by the Laboratory. The ISU campus is served by a district steam and chilled water generating plant and distribution system. The Laboratory does not take responsibility for the infrastructure of these systems until they enter our facility. Ground maintenance is also provided by the University. Because of this unique partnership, there are no site infrastructure modernization projects, which need to be included in the plan.

B. Existing Facilities

1. Rehab/Upgrade

- Systematic Laboratory Space Modernization (GPP). The Ames Laboratory buildings housing research activities have an average age of 48 years. The nature of the research activities and facility needs of that effort have changed dramatically over that time period. With the pace that technology is changing, this trend will continue and accelerate over the next ten years. There is a need to have a systematic program to update and upgrade the occupied space in these buildings, provide effective facilities for the research effort, and achieve a "preferred" work environment. Architectural programming will identify optimal configurations to provide flexible, efficient, and productive research areas. The renovation work will upgrade space layout, utility fixtures, finish materials, laboratory furniture, hoods, information systems, security systems, utility capacity, and flexible distribution of services. An annual program of upgrading 3,000 square feet of net usable space and the associated support spaces (e.g.; corridors, exits, circulation space, and rest rooms) would enable the Laboratory to upgrade approximately 1/4 of its research space during this ten-year plan. This program will also support the ability to accommodate new technology and evolving program emphases. It will provide a systematic means to consolidate program activities and locate cross discipline research staff to enhance collaboration. Support space with advanced telecommunication capabilities will contribute to a broader collaboration across the DOE complex and with other research partners. The cost for modernizing 3,000

square feet of space is $300K. Productivity enhancements of 10 percent are commonly utilized per DOE guidance when Laboratory activities can be consolidated in facilities incorporating current technology and programmed for those activities. Based on this, the modernization would provide a simple payback of six years.

Resource Needs:
GPP – The systematic laboratory space modernization project will require capital improvement funds in the amount of $300K/year. Funds would be required in addition to current funding levels requested to enable this to proceed before FY08.

- Information Technology. Network infrastructure improvements will be phased in and targeted to those with the greatest resource needs. Anticipated improvements will allow the Laboratory to utilize Gigabit Ethernet on the backbone network, voice over IP (VOIP), multicast-based video-conferencing, 10 Gigabit communication speeds, and direct sequence spread spectrum wireless technologies. The Laboratory will be preparing to deploy IPv6 where required to meet scientific goals and security needs.

  Security will be enhanced to accommodate the increased use of information technology to assist in research programs. The Laboratory has a cyber security plan that provides a systematic process to improve cyber security, while allowing research to continue as freely as possible given today's environment. This cyber security plan will require constant improvement as new opportunities and new threats are identified over the next ten years. Current devices implemented in our cyber security plan include bastion hosts, firewall, and intrusion detection. Future improvements include biometric authentication, VLAN security, Virtual Private Networks (VPN), Public Key Infrastructure (PKI), encrypted communication channels, central user account provisioning and administration and Smart cards. In order to implement this technology (VLAN, VPN, VOIP, Video-conferencing), a new router and MultiService Switch will need to be installed to provide additional switching and routing capabilities. GPE funds will be necessary to procure these devices.

  Centralized services will need upgrading over the next ten years. Document management will come to the forefront as a way to reduce the cost of creating, moving, storing, and disposing of records. Digital photocopy/fax/scan systems, along with electronic document storage systems, will be incorporated into the Laboratory's infrastructure. A Storage Area Network (SAN) will be implemented to deliver multiple host access to stored information on a RAID system. This device will provide access to web, email, database, and file/print servers in a fast, scalable and efficient manner. Due to the announced end-of-life of the HP3000, the central administrative computing facilities will migrate to an alternative platform(s) over the next four years. A hardware/software solution

maximizing current investment in knowledge, applications, and vendor relationships will be deployed to keep up with the demand for administrative data and the need to provide critical information to administrative clients. These procurements will require the use of GPE funds.

Remote access techniques will require improvements as the need for secured systems increases. The Laboratory encourages its researchers to collaborate with researchers at other Laboratories and institutions and utilize the user facilities that exist around the DOE and other scientific complexes. Access to the Laboratory's cyber systems will need to be as convenient as possible without exposing the Laboratory to any undue risk. Some of the new tools that will allow remote access include VPNs, remote access equipment controllers, and multicast-based distributive computing.

Resource Needs:
GPE -- The SAN, Router, and Administrative server will require GPE funds. Expectations are that the SAN will be procured and implemented in FY2004 with an upgrade in FY2010, the router will be procured and implemented in FY2005, and the administrative server will be procured in FY2004, implemented in FY2005 with an upgrade in FY2009.

The estimated costs are as follows:

FY2004	$100K
FY2005	$130K
FY2009	$55K
FY2010	$65K

Operating – Improvements to the network infrastructure, security, services, and remote access will be accommodated out of overhead funds. The estimated costs include only the hardware and software to maintain and improve these areas and the annual costs fluctuate based on the timing of the upgrade. The estimated annual costs are as follows:

FY2003	$75K	FY2009	$120K
FY2004	$200K	FY2010	$130K
FY2005	$115K	FY2011	$125K
FY2006	$120K	FY2012	$85K
FY2007	$65K	FY2013	$85K
FY2008	$60K		

2. D&D

Remediation and Renovation of Harley Wilhelm Hall. During the late 1940's and early 1950's, the U.S. Government conducted research and production on Thorium-232 in Harley Wilhelm Hall at the Ames

Laboratory. Thorium production activities continued until 1953. These activities, including production, processing, machining and handling of thorium, resulted in release of the fine-powdered form of thorium. The production processes and design of the building resulted in the contamination of portions of the building. Subsequent remodeling and decontamination activities minimized the contamination levels in occupant-exposure areas and ensured the protection of building occupants and the public. The remaining areas targeted for remediation include utility chases, sub-basement tunnels, and active and abandoned utility components within these spaces.

Successful completion of remediation and renovation will allow unrestricted access to and utilization of these spaces, which are currently restricted through administrative controls. Future work in the building on space remodeling and building system changes would be done without any risk of exposing workers or spreading contamination.

See also ESH&I Plan ADS A99D0003.

Resources Needs:
SC Funding – The remediation and renovation of Harley Wilhelm Hall is estimated at $2,870K. The FY02 ESH&I Management Plan proposed funding for FY2003 through FY2006. This plan reflects the need to push the funding period out to FY2005 through FY2008. Ames will seek direct funding from DOE to fund the remediation of Wilhelm Hall.

FY2005	$480K
FY2006	$670K
FY2007	$765K
FY2008	$955K

C. New Facilities

1. Emerging Technologies Building

• Consolidation of Rented Space/Collaborative Research Space for Emerging Programs: The Laboratory rents approximately 30,000 square feet of space in ISU buildings. The ability to pursue collaborative efforts with ISU staff housed in ISU buildings provides excellent opportunities for flexibility, efficiency, and economy. This is especially true when the initiatives are in the infant stage. However, as these initiatives grow, there is a need for contiguous space in Ames Laboratory facilities to provide quality facilities and the level of support that will allow the program efforts to operate more efficiently. Much of the rented space is inadequate for meeting the needs of 21st century research and the Laboratory cannot pursue capital improvements in rented space. The Laboratory uses space in the Office and Laboratory Building, which is slated for demolition in the ISU

Campus Master Plan. As such, no improvement reinvestments are being made in the building and minimal maintenance is being performed. It is estimated that the research efforts in over 50 percent of the rented space would benefit from dedicated contiguous space in Ames Laboratory facilities. With the collaborative resources of the University, the Laboratory is uniquely positioned to adapt and respond to DOE mission needs in the dynamic research environment of the 21st century. However, to operate efficiently, a new facility designed to provide multipurpose capabilities with built-in flexibility is vital to the success of these ventures.

The new facility is programmed for 30,000 net usable square feet (nusf). Space will be provided for Computational Sciences, the Scalable Computing Lab, Midwest Forensic Research Center, Physical and Biological Chemistry, Biorenewable Resources, and the Catalysis Center. The space is needed to enable team approaches to research initiatives, co-locate activities that will generate collaborative synergy, provide space for displaced activities, relocate activities from rented space, and provide space for new initiatives. To accommodate the Physical and Biological Chemistry activities, some of which will be displaced from the Office and Laboratory Building, will require up to 10,000 net square feet. Locating these activities in one new facility utilizing current design concepts will improve their efficiency and effectiveness.

A 50,000 gross square foot (gsf) building will be built adjacent to existing Laboratory buildings. Lease lines will be adjusted as necessary to incorporate the new building. Design priorities will include built-in flexibility for setting up and rearranging research activities, utility distribution systems with provisions for upgrading to future technologies with minimal disruption to research areas, space layout and telecommunication capabilities to support onsite and offsite collaboration, aesthetics that provide a preferred working environment, and responsible use of resources over a 50-year life cycle of the facility. Sustainable design concepts will be incorporated into the facility, with strong consideration being given to LEEDS certification or LABS21 designation.

Resource Needs:
Line Item Funding – The new facility will require funds estimated at $26M. It is proposed that funds would be requested for FY2006 with design starting then and construction ending in FY2008.

2. Low Level Waste Handling Facility

- Currently, low-level radiological waste is staged in the Waste Handling Facility located approximately 1.5 miles northwest of campus in a non-DOE building. The facility was utilized as a waste facility for the Ames Laboratory Research Reactor during the 1960's and 70's. Upon decommissioning of the Reactor and transfer of the real property to Iowa

State University, Ames Laboratory continued to utilize the facility for Low Level Waste staging as part of a beneficial-use agreement. This proposal would support the establishment of a new Low Level Waste Handling Facility and decontamination of the existing Waste Handling Facility. This effort would reduce the Department's responsibility for a legacy facility and reduce the risks associated with the transfer of Low Level Waste to a remote site via public roads. Department of Transportation regulations are a significant factor when transporting low-level waste from Ames Laboratory buildings to the current Waste Handling Facility. Locating a Low Level Waste Handling Facility in a DOE building on the main campus would decrease transportation considerations.

The previous Strategic Facility Plan proposed building a small ~3,000 gsf building or remodel space at the main campus location for the operation. The low level waste handling needs and operation are being reviewed and other options are being investigated that would significantly reduce the costs to provide the new location for the activities. Discussions with DOE indicate that the project may need to be split into a capital improvement project for remodeling space to relocate the waste handling activities and a decommissioning and decontamination project to deal with the legacy waste issues of vacating the existing building. The decommissioning and decontamination component may be suitable for funding under the Excess Facilities Disposition Program. Consultation with contractor personnel indicates that additional study is needed to establish more accurate decommissioning and decontamination costs for vacating the current site. The resource needs and funding sources will be revised when these activities have been completed.

Resource Needs:
GPP – The FY2004 Field Budget Call requested $314K for this need based on prior plans. The resource needs will be revised based on the results of reviewing the scope of the decommissioning and decontamination activities and the alternative facility options for waste handling activities.

D. Real Property Operations and Maintenance

As discussed earlier, the average age of the research buildings at the Ames Laboratory is 48 years. The Laboratory has traditionally placed a high priority on maintaining the facilities. This ethic of quality has helped to keep our facilities in excellent condition as measured by the Facility Condition Index (FCI) in spite of the age. The overhead funding for the preventive and corrective maintenance efforts in FY2002 was $623K which is slightly over 0.9 percent of the Replacement Plant Value. This value is defined as the Maintenance Investment Index (MII) and has increased over the previous two years. The previous plan set a target of at least one percent for overhead maintenance funding. Current expenditures are very close to that target value. Maintenance Investment Index targets of 1.4 percent in FY2004 and two

percent for FY2005-2013 are currently under consideration. Such a sharp increase in overhead funded maintenance would have a significant impact on overhead rates, other budget priorities, and research expenditures that would have to be carefully managed. These levels are not incorporated into our plan at this time. The one percent funding level should be adequate to keep the facility's FCI in the excellent category and keep deferred maintenance under control. The planned overhead funding for maintenance in FY2003 is $720K, which achieves a MII of slightly over one percent.

See also ESH&I Plan ADS A98D0007.

Resource Needs:
Operating Funds – Funding to support operations and maintenance will need to be maintained at a MII of at least 1 percent. A level of effort equivalent to FY2003 will be needed in FY2004-2007. Starting in FY2009, support levels will need to increase by $75K per year when the proposed new building comes on line.

FY2003	$720K	FY2009	$1.01M
FY2004	$760K	FY2010	$1.06M
FY2005	$800K	FY2011	$1.10M
FY2006	$830K	FY2012	$1.14M
FY2007	$860K	FY2013	$1.19M
FY2008	$900K		

VII. Resources Needs Summary

See attached spreadsheet entitled "Needs Summary Table", Appendix B.

VIII. Plan Development and Prioritization Process

This plan was developed with the assistance of the functional managers in those areas affected by the needs assessment and decision process of this exercise. Those included the Laboratory Director, Deputy Director and the Associate Directors for Science and Administration, the staff responsible for the Lab's planning process, and the various managers (particularly facilities, information services, budget and ESH&A). Reviews of the current Institutional Plan, the deferred maintenance costs, the aging of the DOE –owned buildings and the FCI identified in the Facilities Information Management System (FIMS), budget allocations for GPP and GPE, and other mitigating information such as Iowa State University's Master Plan, projected areas of research funding, the growth of other federal agencies and industrial sponsored research, along with a review of space utilization of Ames Laboratory researchers within University-owned buildings and the condition of that space were done. The plan is updated by functional area managers with input from the Laboratory Management. The revised plan is reviewed by Laboratory Management prior to release.

After a thorough discussion and review of existing information, it was determined that the request for a new research facility, as detailed within the Institutional Plan, was definitely needed in order to retain world-class scientists and make various existing science programs functionally more efficient and effective. It was also determined that a consolidation of ESH&A activities from external University-owned facilities to the main Laboratory site was desired because of safety and transportation issues. A high priority was placed on trying to increase the GPP funds received each year from DOE. GPP funding traditionally falls short of the Lab's needs and therefore major improvements to the infrastructure have to be done in stages over several years. Identified as a priority, there was also the need to upgrade our information communication backbone to keep current with emerging trends and peripherals maintaining open and secure communication with our collaborators around the world.

Once each of these priorities was detailed including project costs, a budget for each project was developed by the functional manager and reviewed by the Budget Office. The detailed explanations and proposed budget for each project was then reviewed one final time and the funding priorities set based on the most pressing needs perceived by the Laboratory's Strategic Facilities Committee.

IX. Performance Metrics and Change Indicators

To achieve the Office of Science vision for 21st century laboratories, facilities must attain high standards for both capability and condition. The Laboratory's performance with regard to the condition of its facilities is currently measured and tracked through the Facility Condition Index contained in the current contract between DOE and ISU. The latest self-assessment found the local facilities to be in "excellent" condition. The FCI is a good indicator to use for the Strategic Facility Plan from the perspective of the facility condition, but it is lacking in terms of measuring the capability of laboratory facilities. It does not track progress toward upgrading facilities to incorporate current technology and practices to meet the needs of scientists doing world-class research in the 21st century.

The whole plan to implement the improvements necessary to achieve this vision is dependent on the availability of funding to carry out these projects and initiatives. To track this critical success factor, a management report will be developed that lists the projects and indicates the funding status. Once projects are funded, we will develop milestones to track the progress of each project.

We will also work with DOE-HQ to more completely develop these projects so that they meet the needs and expectations of DOE and the Laboratory. This will include the proper documentation to get these projects into the queue for approval and funding.

X. Appendices

A. Ames Laboratory Site Plan

B. Ames Laboratory Resource Needs for Achieving Office of Science Vision for 21st Century Labs

Ames Laboratory Site Plan

(boundaries indicated by white lines)

Legend

A. Metals Development Bldg.
B. Spedding Hall
C. Technical & Administrative Services Facility
D. Harley Wilhelm Hall
E. Warehouse
F. Mechanical Maintenance Bldg.
G. Maintenance Shops
H. Paint and AC Shops
K. Construction Storage Shed
L. University-owned, Office & Lab Building. Slated to be demolished.

Not visible in Photo: Records Storage Facility

Needs Summary Table

Laboratory: Ames Laboratory

Project/Activity	Space Added+	Space Removed+	TEC	2002*	2003*	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
				◄ Modernization Needs ►											
REAL PROPERTY MAINTENANCE**				0.6	0.7	0.8	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.1	1.2
(% of RPV)				0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9
INFORMATION TECHNOLOGY SUPPORT**				0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
GPP: Major projects planned***															
Upgrade HVAC/Fume Hood System, Spedding Hall			0.3	0.2											
Fume Hood Upgrade, Wilhelm Hall			0.6	0.3	0.3										
Upgrade Electrical Service, Metals Development Bldg.			0.2		0.2										
Low Level Waste Handling Facility Relocation		9000++	0.3			0.3									
Upgrade Spedding Elevator			0.2			0.2									
Upgrade HVAC, Front Section, Metals Dev. Bldg			0.4			0.4									
Upgrade HVAC System, Spedding Hall			1.8			0.3	0.8	0.7							
Records Holding Area			0.2					0.2							
Upgrade Handicapped Access			0.2						0.2						
Upgrade Freight Elevator, Metals Development Bldg.			0.2						0.2						
Install Fire Sprinklers, Main. Shop Building			0.1							0.1					
Misc. Small Projects/Systematic Space Modernization									0.3	0.6	0.8	0.8	0.8	0.8	0.8
Total GPP				0.5	0.5	1.2	0.8	0.9	0.7	0.7	0.8	0.8	0.8	0.8	0.8
GPE															
General GPE Needs				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total GPE				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
INFRASTRUCTURE LINE ITEM CONSTRUCTION (SLI)*:**															
Emerging Technologies Building	50000	15000+++	26.0					2.0	12.0	12.0					
Total Line Items				0.0	0.0	0.0	0.0	2.0	12.0	12.0	0.0	0.0	0.0	0.0	0.0
Total GPP/GPE/GPF:				0.7	0.7	1.4	1.0	3.1	12.9	12.9	1.0	1.0	1.0	1.0	1.0
DOE Direct Funded Excess Facilities Clean-up and Disposition****															
Non or slightly contaminated: list any projects***															
Wilhelm Hall Remediation++++							0.5	0.7	0.8	0.9					
Subtotal for Non-or slightly contaminated							0.5	0.7	0.8	0.9					
All other contaminated: list any projects***															
Subtotal for all other contaminated															
Total Excess Facilities				0	0.0	0.0	0.5	0.7	0.8	0.9	0	0	0	0	0
Third Party Funding															
List any planned projects***															
Total Third Party				0	0	0	0	0	0	0	0	0	0	0	0

* These columns consistent with actual FY 2002 budget and the President's FY 2003 budget as well as with information provided in response to the FY 2004 Field Budget Call.

** Indirect funded

**** Include all contaminated facilties not transferred to EM

\+ provide where applicable

++ Facility vacated is not in FIMS inventory but is maintained by Ames Laboratory as part of Benefical Occupancy arrangement with Iowa State University

+++ Reduction in rented space. New building will allow consolidation of research activities currently in rented space as well as space to accommodate emerging programs

++++ Project will not result in building being removed from inventory but will allow unrestricted use of the building for ongoing research activity